

WHAT IS CLAIMED IS:

1. A slidably movable member used in contact with lubricating oil, comprising:
a substrate; and
5 a hard carbon-based film coated on a surface of said substrate, said hard carbon-based film having a surface section which contains at least one of nitrogen and oxygen in an amount ranging from 0.5 to 30 at%.
- 10 2. A slidably movable member as claimed in Claim 1, wherein said hard carbon-based film is a diamond film formed by a chemical vapor deposition process.
- 15 3. A slidably movable member as claimed in Claim 1, wherein the surface section of said hard carbon-based film contains at least one of nitrogen and oxygen in an amount ranging from 4 to 20 at%.
- 20 4. A slidably movable member as claimed in Claim 1, wherein said hard carbon-based film has a surface roughness lower than 0.1 μm .
- 25 5. A slidably movable member as claimed in Claim 1, wherein said hard carbon-based film has a hardness Hv higher than 1000.
- 30 6. A slidably movable member as claimed in Claim 1, wherein said hard carbon-based film has a thickness ranging from 1 to 10 μm , wherein said hard carbon-based film has a coefficient of friction of not higher than 0.07 in a condition where said hard carbon-based film is dipped in a lubricating oil.

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7. A slidably movable member as claimed in Claim 1, wherein said substrate is formed of a material selected from the group consisting of silicon nitride and steel.

5 8. A slidably movable member as claimed in Claim 1, wherein said hard carbon-based film is formed of a material selected from the group consisting of diamond polycrystal, amorphous carbon, and diamond like carbon.

10 9. An adjusting shim used in a valve operating mechanism of an internal combustion engine, comprising:

a substrate; and

15 a hard carbon-based film coated on a surface of said substrate, said hard carbon-based film having a surface section which contains at least one of nitrogen and oxygen in an amount ranging from 0.5 to 30 at%.

20 10. A slidably movable member used in contact with lubricating oil, comprising

a substrate; and

a hard carbon-based film coated on a surface of said substrate, said hard carbon-based film having a surface section which contains hydrogen in an amount of not more than 10 at%.

25 11. A slidably movable member as claimed in Claim 1, wherein said hard carbon-based film is formed by one of a carbon ion beam process, a thermal chemical vapor deposition process, an ion plating process, and a sputtering process.

30 12. A slidably movable member used in contact with lubricating oil, comprising:
a substrate; and

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5 a hard carbon-based film coated on a surface of said substrate, said hard carbon-based film having a surface section which contains at least one of nitrogen in an amount ranging from 0.5 to 30 at%, oxygen in an amount ranging from 0.5 to 30 at%, and hydrogen in an amount of not more than 10 at%.

13. A method of producing a slidably movable member used in contact with lubricating oil, comprising:

preparing a substrate;

10 coating a hard carbon-based film on a surface of the substrate by a chemical vapor deposition process; and

15 causing a surface section of the hard carbon-based film to contain at least one of nitrogen and oxygen in an amount ranging from 0.5 to 30 at% by one of a plasma treatment and an ion implantation process.

14. A method of producing a slidably movable member used in contact with lubricating oil, comprising:

preparing a substrate; and

20 coating a hard carbon-based film on a surface of the substrate by one of a carbon ion beam process, a thermal chemical vapor deposition process, an ion plating process, and a sputtering process, to cause a content of hydrogen in a surface section of the hard carbon-based film to fall within a range of not more than 10
25 at%.

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